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The Healing Mantle

The surface-mining of coal and other wealth from the earth leaves desolate vistas, foul streams, and polluted air in its wake. Already over 4 million acres have been ripped up by surface mining operations in harvesting coal, sand and gravel, and some 40 other commodities needed to keep pace with the Nation's domestic and economic growth. Society wants these ravaged and gullied acres restored to usefulness as evidenced by the many State statutes passed or pending that call for some form of reclamation. Progress has been encouraging. The bulk of this Herculean task lies ahead, however, with tomorrow's success dependent on today's research.

It takes a mantle of vegetation to stabilize and reclaim the loose debris of mined terraces and spoil banks. The leaching and eroding of coal mine spoil banks in Appalachia alone send more than 2 million tons of sulphuric acid plus millions of tons of sediment into waterways, often traveling many miles from the actual mining sites. Revegetation would curb further erosion, significantly lessen runoff, beautify the spoils, and produce economic benefits.

Acidity is the main obstacle to revegetation of Eastern coal-mining operations. To overcome it, ARS scientists are studying two basic approaches: raising the pH of soil at the site through fertility management, and selecting plants that can tolerate some acidity. Acidity levels of pH 3.5 and lower can be corrected with lime; at higher pH levels rock phosphate will both correct acidity and supply other elements as nutrients. Scientists have identified numerous species of grasses and legumes that not only thrive on managed sites, but which also yield good harvests of forage. They found on some dry and crusty sites, however, that seedlings could not be established without mulch, a costly material to buy and transport. They solved this problem by planting small grains in the fall, killing the crop with herbicide in the spring, then exploiting the natural mulch by seeding a permanent crop of clover.

In other research, scientists are devising techniques to help vegetation gain a foothold on extremely steep slopes. One such technique involves the cutting of stairstep-sized terraces that hold water, seed, lime, and fertilizer to improve the microclimate for germination and growth, thereby enabling plants to develop deep root systems. All these and many other research efforts underway will provide knowledge for rehabilitating surface mines. Full rehabilitation may be years away, but in time these wastelands will be turned into spirit-lifting places of green that will also provide us with crops, timber, and wildlife.

Editor: R. P. Kaniuka
Editorial Assistant: M. J. Phillips

Contributors to this issue:
R. C. Bjork, V. R. Bourdette, J. P. Dean, P. L. Goodin, G. B. Hardin, W. D. Hutchinson, D. H. Mayberry, M. E. Nicholas, N. E. Roberts, D. H. Senft, L. C. Yarris

COVER: Experimental "soil-layering" machine travels through a North Carolina cornfield to make subsurface application of herbicide to control witchweed—tough and stubborn parasite of corn (0673A1175–4). See story on page 8.

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Earl L. Butz, Secretary
U.S. Department of Agriculture

Talcott W. Edminister, Administrator
Agricultural Research Service

Mr. Dunckelman holds "seed fuzz" which is stored in a deep freeze. This seed was produced from a cross of CP 71–471 (female) and CP 48–103 (male), and produced a total of 688 viable seeds (0673X1242–21).

Breeding Better Sugarcane

SUGARCANE with greater disease resistance and overall higher quality may one day be a reality for sugarcane growers.

Agronomists at the U.S. Sugarcane Field Station at Houma, La., are launched on a new sugarcane breeding program designed to explore the basic *Saccharum* species. Those species which have inherently desirable traits will be combined with established canes having commercially acceptable features.

The successful initial crossing phase during 1972 produced 95 biparental crosses and more than 175,000 viable seeds, many with the hardiness of new "wild" *S. spontaneum* and *S. robustum* lines. For crossing work in 1973, 518 cane cultures of 71 clones (plants produced by budding from a single seedling) are now growing at the field station.

"Agricultural Statistics 1972," points up the need for this basic research. Although the number of acres harvested for sugar in Louisiana rose from 236,000 in 1969 to 305,000 in 1971, the yield of cane per acre fell from 24.1 to

New greenhouse, built to Mr. Dunckelman's specifications, utilizes custom-made flat-bed rail carts, loaded with varieties of sugarcane. These motorized rail carts can be rolled into, or out of, the greenhouse in 5 minutes (0673X2141–28).

21.5 tons. Sugar per ton of cane fell from 189 lbs. in 1969 to 173 lbs. in 1971.

Subsidized by a grant from the American Sugar Cane League, a large greenhouse is nearing completion, enabling ARS agronomist Preston H. Dunckelman to breed specifically for resistance to mosaic and ratoon stunting disease, and in the future for smut, a potential sugarcane plague that has recently entered Hawaii.

In addition to the new structure with its crossing cubicles, seed-maturing racks, automatic temperature controls, and facilities for airlayering (propagation by forcing root growth on plant branches), there will be four photoperiod houses to adjust the daylength for synchronized flowering.

For 1973, about 150 biparental crosses are planned. Expectations are that approximately 250,000 viable seeds will be produced. □

***Right:** Mr. Dunckelman compares 2 of the 518 cane varieties being grown in the sugarcane breeding program. On the left is a wild variety (TINAN 2–96) and on the right L–62–96 a cultivated variety (0673X1241–26). **Below:** Mr. Dunckelman inspects rows of seedlings planted in canefields on grounds of the field station (0673X1241–23)*

A New Way to Tag Insects

MARKING or tagging insects is a necessary step in developing a successful insect control program. By "branding" the insects, scientists can study population densities, distributions, and movement of insects under natural field conditions.

In recent studies at Riverside, Calif., a team of interdisciplinary and Federal-State cooperative researchers tested the use of rubidium to mark insects. Rubidium, a silvery white metallic chemical element, has been found to be a safe, effective, and inexpensive substitute for radioisotopes. Actually, the California scientists are using rubidium chloride—a compound much like common table salt.

A major advantage of this over other methods of marking is that native insects can be marked without altering their normal behavior patterns.

Rubidium is applied as a water spray solution to the foliage or soil of crop plants and is absorbed and translocated rapidly throughout the plants. Phytophagous—herbivorous or plant-eating—insects feed on the treated plants and absorb the rubidium marker which remains with them through successive life-form stages.

When researchers later mass-collect insects, the rubidium-tagged insects can be easily identified by using a laboratory technique called atomic absorption spectroscopy.

The idea that insects could be tagged in such a manner was conceived by ARS entomologist Michael W. Stimmann and agricultural engineer Wayne W. Wolf. At first they were thinking of mercury or similar metals but pollution of the environment reared its ecological head.

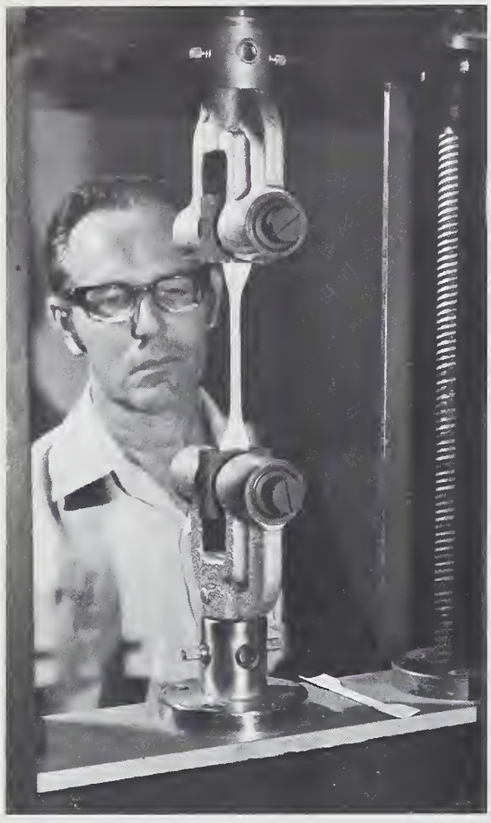
In consultation with the University of California, Riverside, plant physiologist Wade L. Berry, Dr. Stimmann and Mr. Wolf learned that rubidium closely resembles potassium, the mineral nutrient that occurs in the highest concentration in plants, and is used by plants in the same way as potassium. Therefore, rubidium can be accumulated by plants in relatively large amounts without toxic effects. The application rate the researchers have been using is well below the level where plant toxicity might occur.

Since rubidium is found only in low concentrations in most native flora it is possible to spray a given area with rubidium and then identify the insects that have fed and developed there.

In further studies, Dr. Stimmann and others found that the addition of low levels of rubidium to the larval diet of the cabbage looper does not significantly affect the longevity, mating, fecundity, fertility, or pheromone response of the adult moth.

"Additional studies designed to mark large numbers of insects, combined with adequate data on populations emerging from the treated areas, should be useful in providing significant information on the dispersal of species such as the cabbage butterfly and the cabbage looper," Dr. Stimmann reports. □

Making leathers with built-in plastics



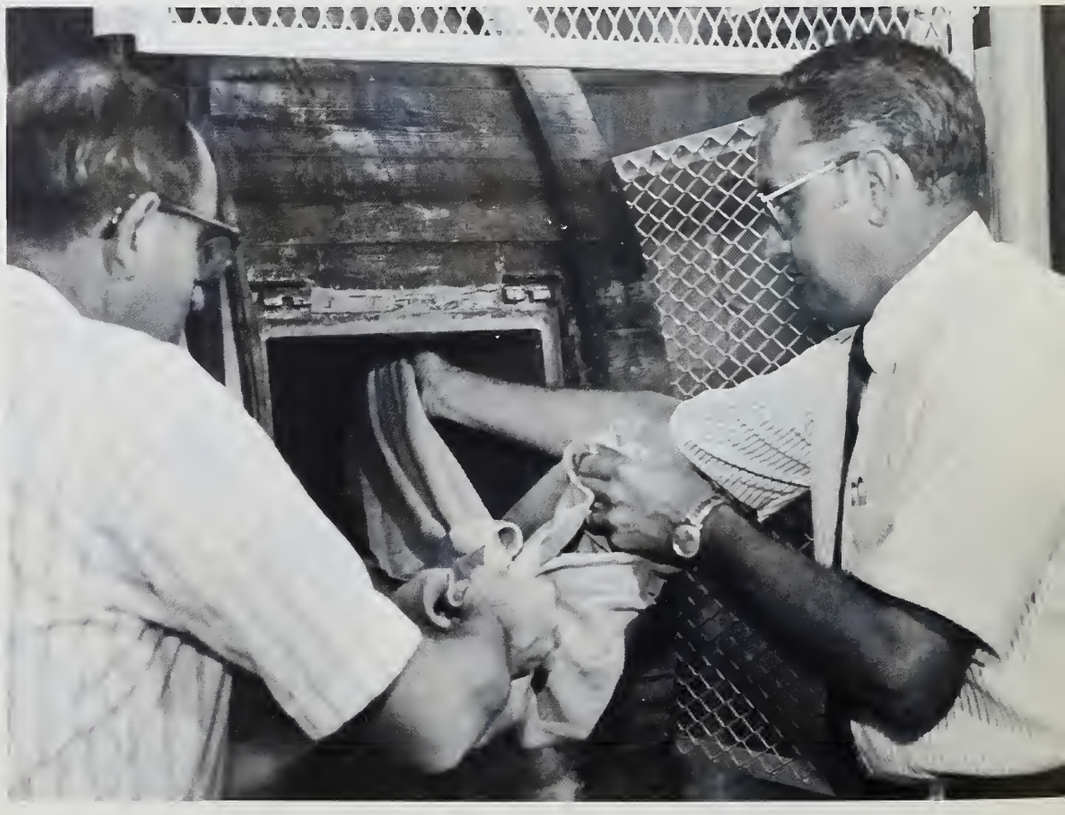
IT'S BEEN DONE with cotton, wool, and starch, and it was bound to happen sooner or later to leather—a chemical wedding of the natural material with synthetic polymers.

As applied to leather, the process is called graft polymerization. It is not simply a coating, mixing, or impregnation of leather with some other material, but a chemical bonding that takes place at the molecular level between the animal hide collagen and a synthetic monomer. What results is an entirely new, permanently modified leather.

Generally speaking, graft polymerization produces a stronger, more uniform leather. The process upgrades the quality of the original material, making some of the usual finishing operations unnecessary. It also makes the leather more receptive to dyes and to functional treatments, such as for water repellency. Depending on particular requirements, graft-polymerized leather can be made either more rigid or more flexible by varying the particular monomer used, the amount, and the conditions of treatment.

The specific conditions under which graft polymerization takes place were worked out by a team of ARS chemists at the Eastern Regional Research Center, Philadelphia, Pa., under the direction of Stephen H. Feairheller. The scientists, Alfred H. Korn, Edward H. Harris, Maryann M. Taylor, and Ed-

Left: Technician William E. Palm stretches a sample of graft-polymerized leather on a Instron tensile tester. Graft polymerization can impart a remarkable degree of extensibility to leather. An unstretched sample is at the base of the instrument (PN–2839).
***Below:** Dr. Feairheller (right) and Mr. Korn put dry ice and then a piece of leather into an experimental tanning drum at the Eastern Regional Research Center's leather-processing pilot plant (PN–2840).*



ward M. Filachione, are seeking to bring the process to the point where it is commercially feasible.

The scientists take chrome-tanned leathers—so far, they have worked with sheepskins, pigskins, calfskins, and cattle hides—and tumble them in a tanning drum for up to 24 hours along with a synthetic monomer, until the monomer links with the collagen to form a new polymer. Chemicals that act as surfactants and initiators are needed to help the process along. Since the reaction takes place only in the absence of oxygen, air in the drum is displaced with carbon dioxide in the form of dry ice.

Rarely is all the monomer combined with the leather actually bound to the collagen. That which is not bound (homopolymer) can be removed with certain solvents. The remaining bound polymer is a measure of the efficiency of the process. The chemists produced leathers with as much as 50 percent bound polymer by weight.

Of a variety of monomer and monomer combinations tried, two provided a full range of property modifications: butyl acrylate and methyl methacrylate. Adding a little acrylic or methacrylic acid to these acrylates virtually eliminated the homopolymer formed.

Butyl acrylate imparts an unusual elasticity which should be beneficial for garment or upholstery leathers. Methyl methacrylate, on the other hand, makes the material quite rigid—too rigid, it seemed at first. Now, however, the rigidity can be controlled, and the sturdy leather produced with built-in methyl methacrylate is a promising new material for shoemaking.

Graft polymerization is now being experimented with in commercial tanneries. It should prove to be a feasible and economical operation. Estimates are that the making of graft-polymerized leather would only cost an additional 1 to 2 cents per square foot compared with ordinary leather. Thus graft polymerization may provide a means for leather to compete with synthetics. □

Lining material that 'weathers-up'

Lining canals and reservoirs to prevent the water seepage that plagues non-lined canals is an expensive proposition. Therefore, some assurance of reasonable "life expectancy" of the lining material must be known before the process begins.

According to current, available specifications, butyl rubber membranes—used as water barriers—have not always performed well when exposed to weather. Additional specifications are needed which directly reflect the performance of the material in a given area, and practicality dictates the need for a short test period.

To provide information necessary for such additional specifications, agricultural engineer Allen R. Dedrick, Phoenix, Ariz., studied the effects of seasonal variation, and membrane elongation and thickness on the butyl deterioration rate at Logan, Utah.

Mr. Dedrick found that test times for evaluating the weathering resistance of butyl rubber membranes can be cut if membrane thickness, stress, and seasonal climate are considered in addition to the physical specifications that are currently considered.

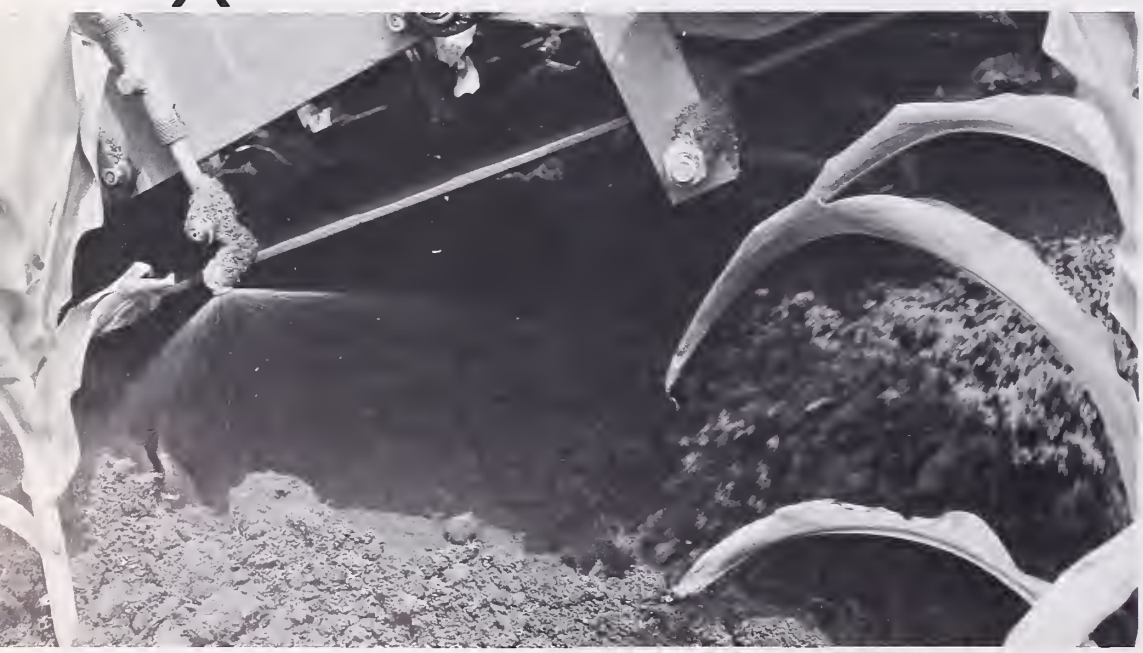
Mr. Dedrick attached 1-inch wide unreinforced butyl strips to an exposure board, stretching each sample either 25, 50, or 100 percent. He then mounted the exposure boards on racks outdoors at 45 degree angles facing south. New samples, $\frac{1}{16}$- and $\frac{1}{32}$-inches thick were added to the exposure boards six times, (from April to September) to evaluate seasonal effects.

Study results showed that seasonal variation is affected by both temperature and atmospheric ozone content. Ozone deteriorates the butyl, and warm temperatures accelerate the process. As temperature and ozone increase, butyl deterioration rate increases. In Logan, deterioration rate in August was twice the rate in April.

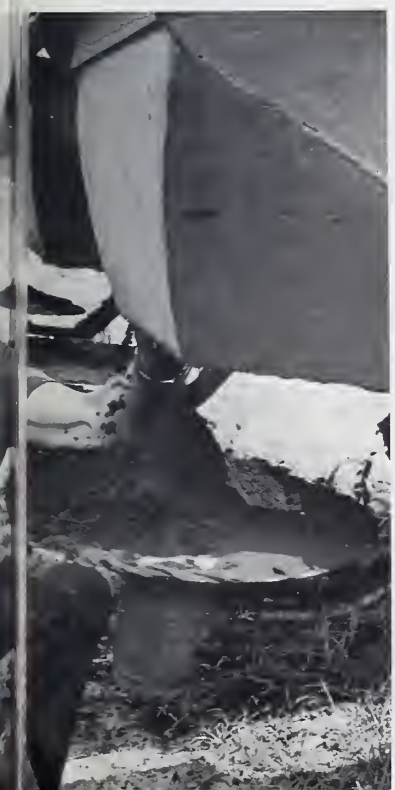
Mr. Dedrick's study also showed the slight elongation (25 percent) significantly increases deterioration rate. Decreasing sample membrane thickness (from $\frac{1}{16}$ to $\frac{1}{32}$ inch) increases deterioration rate too, by about 5 times. Taking season, thickness, and stress into consideration an outdoor evaluation program can quickly determine which butyl liner material best resists the worst outdoor conditions a given area offers. □

Right: A cornfield that would otherwise show severe emergence of witchweed remains free of this parasitic pest due to a subsurface application 4 weeks previous. Engineering technician Edgar M. Carter makes a post-treatment inspection (0673A1167–26).
Below left: Herbicide is sprayed on freshly exposed soil as spinning spreaders deposit a new covering of 1 to 1½ inches of earth (0673A1169–24).
Below right: Mr. Carter inspects spreaders which distribute soil over the herbicide (0673A1167–21).

Rx for witchweed: Soil-layering



machine



A new soil-layering machine can provide season-long control of witchweed through a single application of herbicide. In time, the machine should hasten the control and eradication of this stubborn plant pest.

The machine, developed at USDA's Animal and Plant Health Inspection Service (APHIS) laboratory, Whiteville, N.C., represents a new concept in herbicide application. It enables, for the first time, a subsurface soil application of a herbicide in an established crop. This permits the use of herbicides the crop may not otherwise tolerate.

Presently confined to adjoining areas of North Carolina and South Carolina, witchweed is a parasitic plant that attacks corn, sorghum, sugarcane, small grains, and several grasses. Its roots attach themselves to the roots of host plants, robbing them of food and water. Damage to host plants resembles that caused by severe drought—stunted growth and wilting. If heavily parasitized, host plants may die.

Witchweed is normally controlled by killing new growth. Each year, the emerging weeds are destroyed with herbicides before they can flower and produce seeds to spread the infestation. Depending on the amount of weed growth, two or more applications of herbicides are required each season.

Flowering and seed production by witchweed can also be eliminated by preventing new growth. This is the theory behind the new machine. It applies herbicide in a continuous layer under the soil surface. The continuous layer of herbicide creates a barrier through which the witchweed plant will not penetrate. Unable to emerge from the soil, the plant cannot flower and produce seeds, and eventually dies. The herbicide currently being used in the treatment program is trifluralin. Crop scientist Robert E. Eplee and other research personnel at the laboratory found that a single application of trifluralin would give full-season control of the weed—if the herbicide was applied in a continuous layer under the surface of the soil. However, until development of the soil-layering machine, this herbicide could be used only as a preplant treatment in selected crops. The new machine allows below-the-surface application among growing crops that otherwise might be damaged by a preplant application.

Briefly, this is how the machine works: A horizontal blade scoops up an 18-inch swath of soil, 1 to 3 inches thick, between the rows of a growing crop. As this soil moves up a conveyor belt, the herbicide is sprayed on freshly exposed subsoil surface by nozzles located underneath the conveyor belt. The conveyor belt drops the scooped-up soil onto a spinning spreader which distributes it evenly across the layer of herbicide. Thus, a continuous layer of herbicide is put down and then covered with 1 to 1½ inches of soil.

The machine treats three rows at a

In greenhouse research, corn is infested with witchweed to study the effectiveness of various herbicides. Here, Dr. Eplee observes damage to corn caused by heavy parasitization (0673A1176–21).

time, while traveling at a speed of 3 to 6 miles per hour. It performs best in firm soil, but also does well in light sandy soils and heavy clays. Some problems are encountered on rocky soils and steep slopes.

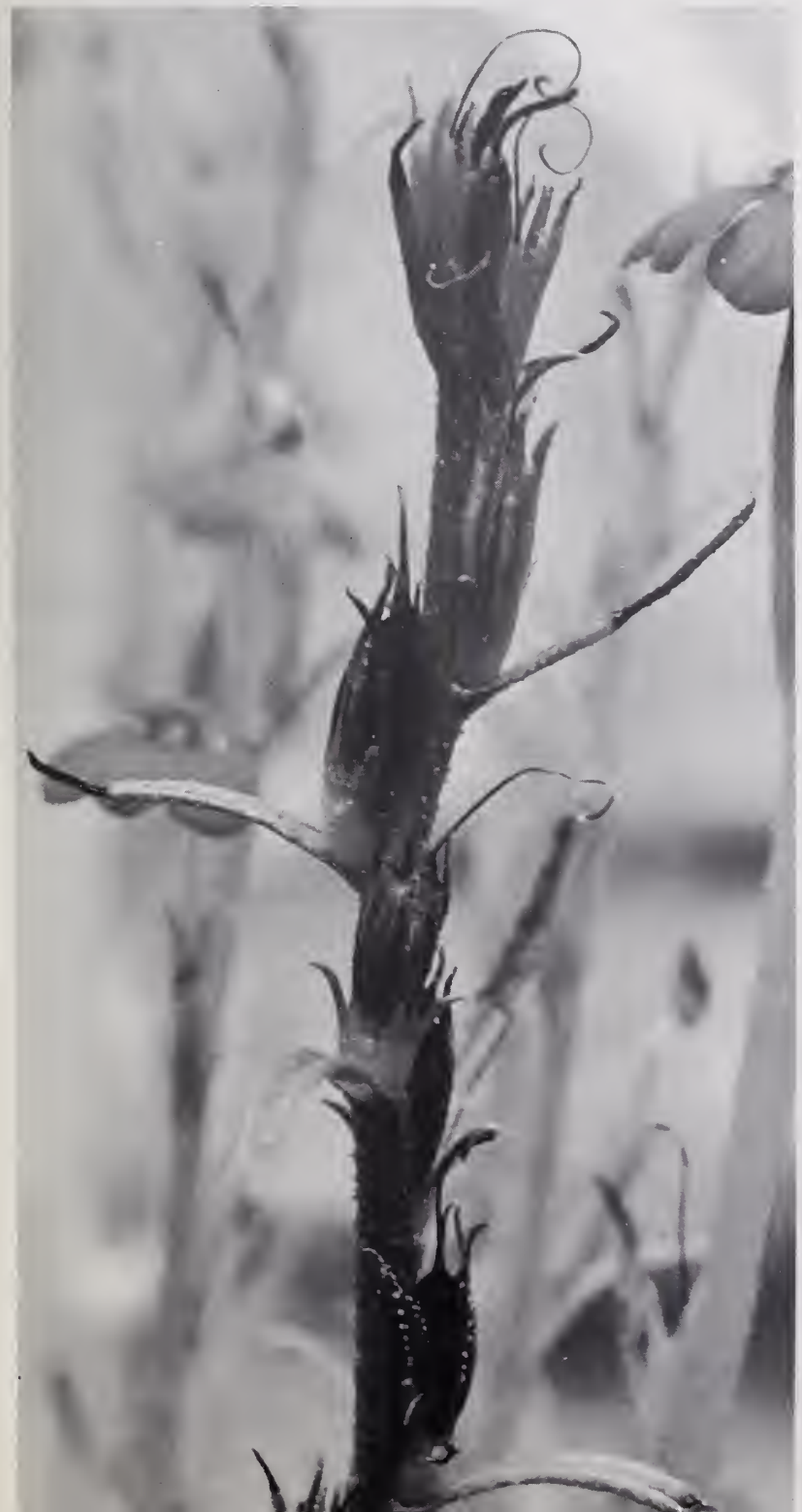
A moderate infestation of other weeds or grass does not interfere with the machine's operation. For most effective operation, the amount of soil moisture should be similar to that for good cultivation.

The 1972 witchweed season was the first year the equipment was extensively tested. Tests were run principally in corn, but cotton, soybeans, and bell peppers were also treated. (Cotton, soybeans, and bell peppers are not parasitized, but these crops and others produce a stimulant that causes germination of the witchweed seed.)

Test results were very encouraging. Not only was full-season witchweed control obtained, but so was full-season control of such grasses as crabgrass and other grassy weeds that serve as hosts for witchweed. To achieve eradication, fallow land, the crop attacked by witchweed, and nonhost crops must be kept free of host grasses to avoid reproduction of this parasite. No crop damage was observed with this treatment.

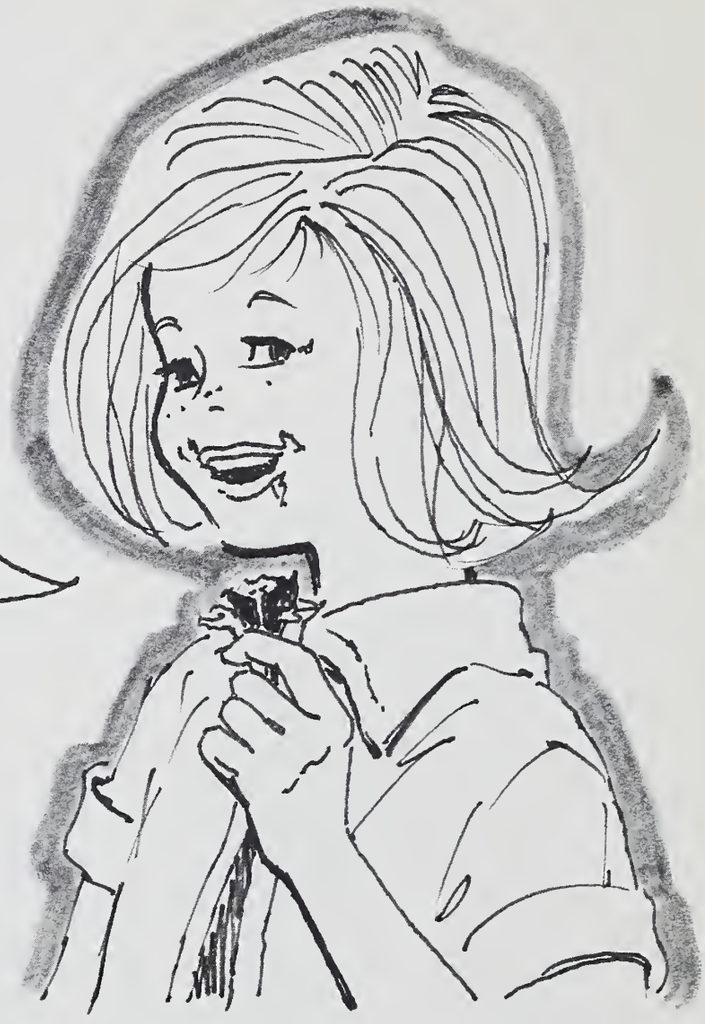
When fully tested, the new machine will be utilized in the APHIS-State cooperative witchweed control program. It may also prove useful in other plant pest control programs, such as horticultural crops, including use in nurseries, and vegetable crops. □

Below left: *Each of these ripe witchweed seed pods contains approximately 25,000 seeds. Microscopic in size, they can remain viable in soil for 20 years (0673A1169–3).* ***Below right:*** *Long before witchweed is visible above ground, it has already inflicted heavy damage on corn. Its intertwining roots attach themselves to those of the host plants, sapping nutrients and moisture (0673A1168–20).*



Closeup view of heavily segmented hostoria of witchweed that has attached itself to a section of corn root (0673A1169–28).

Candy ____ with Protein?



"EAT YOUR CANDY, it's good for you," is a line that parents may soon be uttering to their offspring with the advent of an appealing, nutritionally balanced and protein-rich candy.

People, young and old, eat candy primarily for enjoyment. Many children, given half a chance, will feast on candy to the exclusion of other food. Candy is a good source of quick energy, but it mostly provides carbohydrate calories and very little of the other required nutrients. When consumed regularly, or in significant amounts, candy can adversely affect a person's nutritional status because of unmet daily niacin and thiamine vitamin requirements.

Starting with the premise that people will continue to eat candy for enjoyment, chemists Carl E. Vandercook and Carrie M. Borden, Pasadena, Calif., developed a product that is nutritionally balanced, yet remains acceptable and salable.

The nutritious candy is made by first boiling a sucrose-corn sirup solution to reduce its moisture content. After removing the sugar sirup from the heat, fat, flavorings, nutrient fortification mixtures, and finally dry protein are added. The protein is added last to avoid the detrimental effect on the biological quality of protein that occurs when it is cooked with sugar.

Numerous bland-tasting and high-quality protein sources are available. The ARS scientists usually used nonfat dry milk, but also tried soy protein isolates and casein mixtures. Cottonseed, peanut, and fish protein concentrate offer other possibilities.

Synthetic vitamin and mineral supplements can be added, although Mr. Vandercook and Ms. Borden selected yeast, believing that a natural source would be more appealing. Some vitamins, notably A and C, have to be added directly, since sufficient amounts are not found in typical ingredients.

The new candy's protein quality compares quite favorably with casein, one of nature's best sources of protein. And it tastes good, too.

Samples passed out at a school carnival drew overwhelming favorable responses from children and adults. Informed of its nutritional value and told it would cost 2 to 3 cents more than regular candy bars, 46 people said they would still buy it, while only 1 person said no. In competition with other candy at 10 cents a bar, the ARS candy sold out long before the other candy.

Having passed its initial sales test, this experimental candy affords the confectionery industry an opportunity to market a product that is as "good for you" as it is "good to eat." □

Oats for Modern Foods

MOST PEOPLE—wives and mothers especially—know that protein has primary nutritional value. They may not know that it also has functional value in processed foods.

Consider wheat gluten, for example. This protein's classic function is to trap gasses and hot air, thereby causing dough to rise. Protein from corn or soybeans can hold moisture in baked goods or meat products. Soy protein can carry colors and flavors in canned and processed meats.

Most functional proteins are less specialized and more easily replaced than gluten. Any plentiful protein that is free of objectionable flavor can compete in the 3-billion-pound, annual market.

Oat protein, isolated and concentrated by chemists of the Northern regional research laboratory, Peoria, Ill., seems qualified to enter the competition. It tastes bland, has good nutritional value with the best amino acid balance of the cereal proteins, and could be produced in commercial quantities by either the wet or dry milling process.

Soluble under acidic conditions (about 80 percent around pH 2.5), oat protein appears to have functional value in beverages, and the Peoria chemists are studying this possibility. They have made acidic beverages with up to 3 percent protein, fruit flavoring, and sugar. Although the beverages have no undesirable flavor they are slightly astringent.

Oat protein would have functional value in meats because it is stable in emulsions with water and fats, and in baked goods because it can hold moisture to help maintain freshness.

The composition as well as the functional properties of protein obtained by the wet processing of dehulled oats, known as groats, of two varieties were compared by chemists James E. Cluskey, Y. Victor Wu, George E. Inglett, and Joseph S. Wall. Ground groats were mixed with dilute alkali solution to dissolve the protein for separation by sieving, centrifuging, and precipitation.

Garland oats, high in protein (17.2 percent) yielded more starch as well as more protein than moderate-protein (14.2 percent) Wyndmere. Garland protein, furthermore, contained more of the scarce sulfur amino acids and had better storage stability than Wyndmere protein.

The Garland variety's performance accents the significance of breeding oats for high protein. "It is most encouraging that high-protein Garland gives better yields of both starch and concentrate with more protein than does moderate-protein Wyndmere," Dr. Cluskey points out. "The net cost to make oat protein concentrate will depend to a large extent on the value of the starch also produced. Furthermore, if oats are developed with higher protein levels than now available, they should yield lower cost protein."

Dr. Wu and chemical engineer Arthur C. Stringfellow reached similar conclusions in dry milling studies of Garland and moderate-protein (12.8 percent) Sioux oats. The high-protein variety gave the best air classification response, as it had in the wet milling studies. Air classification is a way of separating dry, ground grain into high-protein and high-starch fractions by centrifugal force and fast-moving air.

Air-classified products ranged from 4 to 88 percent in protein content. By mixing these products it is possible to achieve protein levels that fit almost any requirement. □

Oat protein, isolated and concentrated by chemists Y. Victor Wu (left), James E. Cluskey (right), and other scientists and engineers at the Northern Regional Research Center, has properties needed to compete in the annual market for 3 billion pounds of functional protein (1272A1571–11).

Thirty years of peanut research

WORKING FOR PEANUTS? Researchers are and it's paying off in improved consumer products.

Processing peanuts has been a concern of the ARS Southern Regional Research Center at New Orleans for about 30 years. Early investigations included studies on the composition of peanuts and a detailed study of the factors involved in roasting and grinding peanuts for peanut butter.

When synthetic fibers were a hot new item, scientists solved the problems involved in producing proteinaceous fibers from peanuts for the manufacture of textiles. The fibers proved as good as some grades of wool and for a time were made commercially, but finally gave way to the purely synthetic fibers.

Other early advances included excellent food-grade peanut protein concentrates and isolates. They were comparable to today's soybean products, but were ahead of their time in the marketplace.

Current research efforts are limited to direct food and feed uses, with the major emphasis on food.

To gain consumer acceptance a product must taste good at the time of consumption, however tasty it may have been at the time of manufacture. And, hopefully, it should also be nutritious.

Peanuts contain about 25 percent protein of high quality and are also an excellent source of energy. They contain very little moisture so they do not spoil very readily. However, they contain about 50 percent unsaturated fatty acid, and are subject to flavor changes because of its instability.

From the point of view of those who are concerned with calorie counting, the high oil content may be a disadvantage. This concern prompted the development of partially defatted peanuts. While "dry roasting" does nothing about removing calories from peanuts—it only avoids the very few calories gained from oil roasting—partially defatting the peanuts can actually remove as much as 50 percent of the calories.

The ARS-developed process involves squeezing the oil from the raw kernels, treating with hot water to regain normal kernel shape, and roasting. The result is a product with the natural shape and flavor of peanuts but with substantially fewer calories.

In addition to use as a new peanut product, the partially defatted kernels, after coarse grinding, can be used as a carrier for other flavors, notably those of black walnuts and pecans, in confections.

The partial loss of "peanutty" flavor in the processing of partially defatted peanuts, together with the well-known and much-complained-about loss of flavor of salted peanuts after roasting, gives peanut flavor studies an important place in research on peanuts.

Peanut flavor, like most other natural flavors, involves the combined impact on the taste buds of a great many different chemical compounds. To date, more than 200 different compounds have been identified in peanut flavor concentrates.

So far, most of the effort has been devoted to determining "what" is present in peanut flavor. Now that highly sophisticated instrumentation has become available for measuring even the very smallest tract amounts, scientists are beginning to measure "how much" of each of the various compounds is present.

In current research on peanut flavors scientists are emphasizing the development of methods to determine what chemical reactions take place during roasting in the complex compound of mixtures. When the scientists learn what is happening they can then seek ways to prevent or retard the undesirable changes that occur in all peanut products during storage. □

Heat-stressed cattle can gain

BEEF ANIMALS exposed to heat stress for several weeks may gain less weight than unstressed animals, but apparently the effect can be overcome after ideal conditions are restored.

ARS agricultural engineer G. LeRoy Hahn, in cooperation with scientists at the Missouri Agricultural Experiment Station, Columbia, kept steers in an 86° F. environment for 6 weeks and then at 68° F. for another 6 weeks. Control steers were kept in rooms maintained at 68° F. during the entire test period. Both groups consumed about the same amount of feed to achieve the same body weights during the experiment.

If further research verifies present growth results, feedlot managers may need to retain fattening animals for a period of time following prolonged heat stress or provide some sort of cooling system to avoid growth reductions. No recommendations are being made yet, however.

As part of this research, scientists studied changes in body composition at the University of Missouri's Low Level Radiation Laboratory. The whole body counter provides an estimate of the amount of lean tissue in animals without actually slaughtering the animals. It measures a radioactive isotope of potassium called K^{40}, universally present in animals, primarily in lean tissue.

After the readjustment period, steers that had undergone heat stress had about 1 percent more fat than the control steers—not enough difference to significantly relate to market quality.

During heat stress, however, percentage of fat in the steers decreased slightly. Apparently, stored fat was being used to support protein formation while nutrients from decreased feed intake were being used to produce protein rather than fat.

Increased water in the bodies of stressed animals was believed to contribute to nonfat gains. After the steers were relieved of heat stress, weight gains consisted of a higher proportion of fat than in control animals.

Heat stress and milk

DAIRYMEN who blame heat stress for high leukocyte counts in milk had better take a harder look at their management practices.

Dairy scientists led by Max J. Paape at Beltsville, Md., have found no evidence that high leukocyte counts in milk are related to heat stress.

Leukocytes (white blood cells) are normal constituents of milk. However, high concentrations of these cells indicate the presence of mastitis. Federal regulations require testing of milk to make sure that an excess of leukocytes is not present. Milk with abnormal amounts is barred from the market. Many Southern dairymen, especially, are convinced that excess leukocytes in milk of their cows are due to heat stress.

Five or six Holstein cows were involved in each of eight trials at Beltsville to test this theory. Control cows were kept at 70° F., while test cows were kept at a constant temperature of 90° F. or at fluctuating temperatures (90° F. during the day, 70° F. at night) for either 2 or 4 weeks.

In all cases, body temperature increased and milk production decreased at the higher temperatures. However, neither constant nor fluctuating temperature stress had any effect on leukocyte concentration in the milk. The tests produced no results supporting the contention that heat stress causes high leukocyte counts.

Wurset process under test

FULL-SCALE commercial trials are underway for a new wool wash treatment.

The Wurset shrink-resist process, developed at the Western Regional Research Center, Berkeley, Calif., is being evaluated by Carleton Woolen Mills, Winthrop, Maine, following a 2-week series of trials conducted recently by ARS chemical engineer Willie Fong and chemist Clay E. Pardo, Jr.

Preliminary trials involved treatment of more than 10,000 yards of woolen fabric. Carleton's president and technical director agree that the Wurset process represents a significant improvement over all currently used resin-based treatments for machine washable woolens.

Chemical treatment costs no more than present processes used by the firm.

Besides minimizing shrinkage, Wurset retains the aesthetic handle—the way wool feels—one of the more important items when developing a washable wool.

Based on the above favorable factors, the firm has decided to proceed with

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full-scale production runs involving treatment of up to 300,000 yards of fabric with some experimental chemical and equipment furnished by the ARS Agribusiness Program.

The runs will be carried out over the next several months and will include treatment of woolen fabrics of all types, construction, blend level, and end-use. If everything goes well, the probabilities are excellent that the firm will go fully commercial with the Wurset process.

Deer repellent from bay leaves?

WILD DEER in California cause millions of dollars damage to young Douglas-fir trees, *Pseudotsuga taxifolia*, annually. The deer, which are protected by law, eat the tender tree tips which in turn causes the trees to grow crookedly with uneven branching.

After observing that deer do not eat leaves from the California "Bay" tree, *Umbellularia californica*, scientists at the Western Regional Research Center, Berkeley, Calif., hope to separate the leaves' active ingredient and spray it on young pine trees as a deer repellent.

The scientists analyzed 25 chemicals found in bay leaves by capillary and packed gas chromatography separation, with characterization by mass and infrared spectrometry. The most promising chemical compound seems to be methyl eugenol. The scientists are now running toxicity tests on mice and fish. It appears from current data that the chemical at its concentration in the leaves is no more toxic than common spices found in the kitchen. In fact, these leaves are currently being marketed by a food-processing firm in California as a flavoring ingredient.

This research is being conducted by ARS chemists Ron G. Buttery, Dale R. Black, Dante G. Guadagni, and Roy Teranishi, pharmacologist Laurence L. Layton, and technician Louisa Ling. Animal physiologist Guy Connolly, University of California, Davis, cooperated with the ARS scientists.

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

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